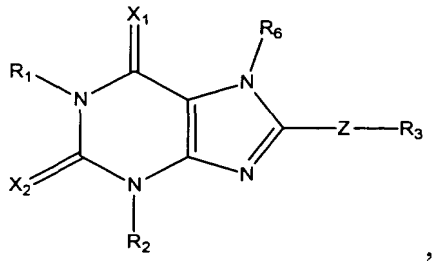
What is claimed is:

1. A compound comprising the formula:



,

wherein $\mathbf{R_1}$ and $\mathbf{R_2}$ are independently selected from the group consisting of:

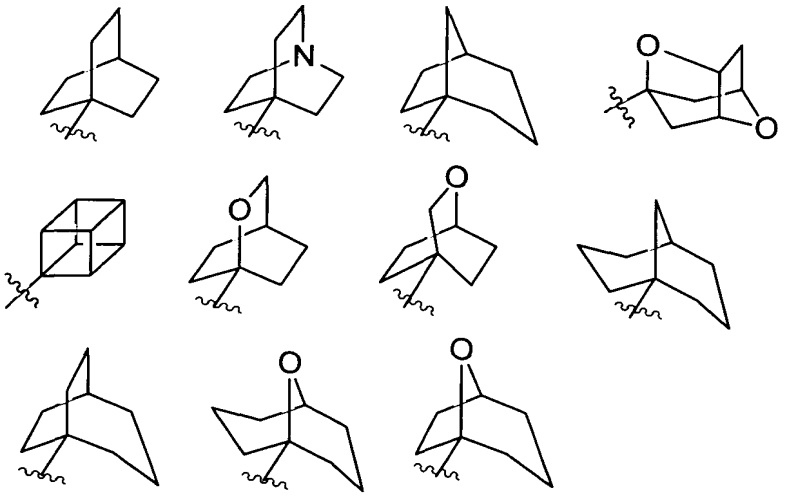
a) hydrogen;

b) alkyl, alkenyl of not less than 3 carbons, or alkynyl of not less than 3 carbons; wherein said alkyl, alkenyl, or alkynyl is either unsubstituted or functionalized with one or more substituents selected from the group consisting of hydroxy, alkoxy, amino, alkylamino, dialkylamino, heterocyclyl, acylamino, alkylsulfonylamino, and heterocyclylcarbonylamino; and

c) aryl or substituted aryl;

$\mathbf{R_3}$ is selected from the group consisting of:

(a) a bicyclic, tricyclic or pentacyclic group selected from the group consisting of:



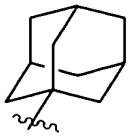
,

wherein the bicyclic or tricyclic group is either unsubstituted or functionalized with one or more substitents selected from the group consisting of:

(a) alkyl, alkenyl, and alkynyl; wherein each alkyl, alkenyl, or alkynyl group is either unsubstituted or functionalized with one or more substituents selected from the group consisting of (amino)(R_5)acylhydrazinylcarbonyl, (amino)(R_5)acyloxycarboxy, (hydroxy)(carboalkoxy)alkylcarbamoyl, acyloxy, aldehydo, alkenylsulfonylamino, alkoxy, alkoxycarbonyl, alkylaminoalkylamino, alkylphosphono, alkylsulfonylamino, carbamoyl, R_5, R_5-alkoxy, R_5-alkylamino, cyano, cyanoalkylcarbamoyl, cycloalkylamino, dialkylamino, dialkylaminoalkylamino, dialkylphosphono, haloalkylsulfonylamino, heterocyclylalkylamino, heterocyclylcarbamoyl, hydroxy, hydroxyalkylsulfonylamino, oximino, phosphono, substituted aralkylamino, substituted arylcarboxyalkoxycarbonyl, substituted heteroarylsulfonylamino, substituted heterocyclyl, thiocarbamoyl, and trifluoromethyl; and

(b) (alkoxycarbonyl)aralkylcarbamoyl, aldehydo, alkenoxy, alkenylsulfonylamino, alkoxy, alkoxycarbonyl, alkylcarbamoyl, alkoxycarbonylamino, alkylsulfonylamino, alkylsulfonyloxy, amino, aminoalkylaralkylcarbamoyl, aminoalkylcarbamoyl, aminoalkylheterocyclylalkylcarbamoyl, aminocycloalkylalkylcycloalkylcarbamoyl, aminocycloalkylcarbamoyl, aralkoxycarbonylamino, arylheterocyclyl, aryloxy, arylsulfonylamino, arylsulfonyloxy, carbamoyl, carbonyl, -R_5, R_5-alkoxy, R_5-alkyl(alkyl)amino, R_5-alkylalkylcarbamoyl, R_5-alkylamino, R_5-alkylcarbamoyl, R_5-alkylsulfonyl, R_5-alkylsulfonylamino, R_5-alkylthio, R_5-heterocyclylcarbonyl, cyano, cycloalkylamino, dialkylaminoalkylcarbamoyl, halogen, heterocyclyl, heterocyclylalkylamino, hydroxy, oximino, phosphate, substituted aralkylamino, substituted heterocyclyl, substituted heterocyclylsulfonylamino, sulfoxyacylamino, and thiocarbamoyl; and

(b) the tricyclic group:



,

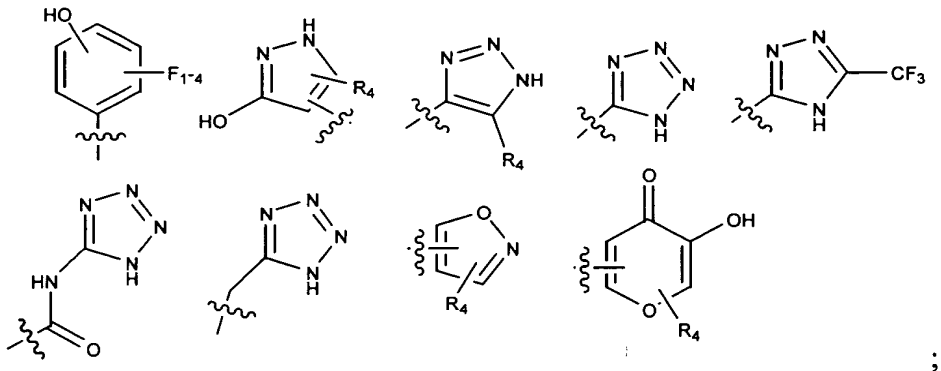
wherein the tricyclic group is functionalized with one or more substituents selected from the group consisting of:

(a) alkyl, alkenyl, and alkynyl; wherein each alkyl, alkenyl, or alkynyl group is either unsubstituted or functionalized with one or more substituents selected from the group consisting of (amino)(R_5)acylhydrazinylcarbonyl, (amino)(R_5)acyloxycarboxy, (hydroxy)(carboalkoxy)alkylcarbamoyl, acyloxy, aldehydo, alkenylsulfonylamino, alkoxy, alkoxycarbonyl, alkylaminoalkylamino, alkylphosphono, alkylsulfonylamino, carbamoyl, R_5, R_5-alkoxy, R_5-alkylamino, cyano, cyanoalkylcarbamoyl, cycloalkylamino, dialkylamino, dialkylaminoalkylamino, dialkylphosphono, haloalkylsulfonylamino, heterocyclylalkylamino, heterocyclylcarbamoyl, hydroxy, hydroxyalkylsulfonylamino, oximino, phosphono, substituted aralkylamino, substituted arylcarboxyalkoxycarbonyl, substituted heteroarylsulfonylamino, substituted heterocyclyl, thiocarbamoyl, and trifluoromethyl; and

(b) (alkoxycarbonyl)aralkylcarbamoyl, aldehydo, alkenoxy, alkenylsulfonylamino, alkoxy, alkoxycarbonyl, alkylcarbamoyl, alkoxycarbonylamino, alkylsulfonylamino, alkylsulfonyloxy, amino, aminoalkylaralkylcarbamoyl, aminoalkylcarbamoyl, aminoalkylheterocyclylalkylcarbamoyl, aminocycloalkylalkylcycloalkylcarbamoyl, aminocycloalkylcarbamoyl, aralkoxycarbonylamino, arylheterocyclyl, aryloxy, arylsulfonylamino, arylsulfonyloxy, carbamoyl, carbonyl, -R_5, R_5-alkoxy, R_5-alkyl(alkyl)amino, R_5-alkylalkylcarbamoyl, R_5-alkylamino, R_5-alkylcarbamoyl, R_5-alkylsulfonyl, R_5-alkylsulfonylamino, R_5-alkylthio, R_5-heterocyclylcarbonyl, cyano, cycloalkylamino, dialkylaminoalkylcarbamoyl, halogen, heterocyclyl, heterocyclylalkylamino, oximino, phosphate, substituted aralkylamino, substituted heterocyclyl, substituted heterocyclylsulfonylamino, sulfoxyacylamino, and thiocarbamoyl;

R_4 is selected from the group consisting of hydrogen, C_{1-4}-alkyl, C_{1-4}-alkyl-CO_2H, and phenyl, wherein the C_{1-4}-alkyl, C_{1-4}-alkyl-CO_2H, and phenyl groups are either unsubstituted or functionalized with one to three substituents selected from the group consisting of halogen, -OH, -OMe, -NH_2, NO_2, benzyl, and benzyl functionalized with one to three substituents selected from the group consisting of halogen, -OH, -OMe, -NH_2, and -NO_2;

$\mathbf{R_5}$ is selected from the group consisting of $-CH_2COOH$, $-C(CF_3)_2OH$, $-CONHNHSO_2CF_3$, $-CONHOR_4$, $-CONHSO_2R_4$, $-CONHSO_2NHR_4$, $-C(OH)R_4PO_3H_2$, $-NHCOCF_3$, $-NHCONHSO_2R_4$, $-NHPO_3H_2$, $-NHSO_2R_4$, $-NHSO_2NHCOR_4$, $-OPO_3H_2$, $-OSO_3H$, $-PO(OH)R_4$, $-PO_3H_2$, $-SO_3H$, $-SO_2NHR_4$, $-SO_3NHCOR_4$, $-SO_3NHCONHCO_2R_4$, and the following:



;

$\mathbf{X_1}$ and $\mathbf{X_2}$ are independently selected from the group consisting of O and S;
$\mathbf{Z}$ is selected from the group consisting of a single bond, $-O-$, $-(CH_2)_{1-3}-$, $-O(CH_2)_{1-2}-$, $-CH_2OCH_2-$, $-(CH_2)_{1-2}O-$, $-CH=CHCH_2-$, $-CH=CH-$, and $-CH_2CH=CH-$; and
$\mathbf{R_6}$ is selected from the group consisting of hydrogen, alkyl, acyl, alkylsufonyl, aralkyl, substituted aralkyl, substituted alkyl, and heterocyclyl.

2. The compound of claim 1, wherein the compound is in a form selected from the group consisting of an achiral compound, a racemate, an optically active compound, a pure diastereomer, a mixture of diastereomers, and a pharmacologically acceptable addition salt.

3. The compound of claim 1, wherein $\mathbf{R_1}$ and $\mathbf{R_2}$ are each alkyl groups.

4. The compound of claim 1, wherein $\mathbf{R_1}$ and $\mathbf{R_2}$ are each n-propyl.

5. The compound of claim 1, wherein $\mathbf{R_1}$ is n-propyl and $\mathbf{R_3}$ is selected from the group consisting of aralkyl substituted with -OH, -OMe, or -halogen; methyl; and 3-hydroxypropyl.

6. The compound of claim 4, wherein $\mathbf{Z}$ is a single bond.

7. The compound of claim 6, wherein $\mathbf{R_3}$ is:

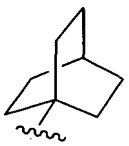
and wherein $\mathbf{R_3}$ is either unsubstituted or functionalized with one or more substituents selected from the group consisting of hydroxy, R_5-, and R_5-alkenyl.

8. The compound of claim 7, wherein the compound is 5-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[3.2.1]octane-1-carboxylic acid.

9. The compound of claim 7, wherein the compound is 8-(4-Hydroxy-bicyclo[3.2.1]oct-1-yl)-1,3-dipropyl-3,7-dihydro-purine-2,6-dione.

10. The compound of claim 7, wherein the compound is 5-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[3.2.1]octane-2-carboxylic acid.

11. The compound of claim 6, wherein $\mathbf{R_3}$ is



and wherein $\mathbf{R_3}$ is either unsubstituted or functionalized with one or more substituents selected from the group consisting of hydroxy, R_5-alkyl, -R_5, R_5-alkenyl, alkoxycarbonyl, alkoxycarbonylalkyl, alkoxycarbonylalkenyl, hydroxyalkyl, aldehydo, alkoxyalkyl, R_5-alkoxy, phosphate, R_5-alkylcarbamoyl, and R_5-alkyl(alkyl)carbamoyl.

12. The compound of claim 11, wherein the compound is 8-(4-Hydroxy-bicyclo[2.2.2]oct-1-yl)-1,3-dipropyl-3,7-dihydro-purine-2,6-dione.

13. The compound of claim 11, wherein the compound is 4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]octane-1-carboxylic acid.

14. The compound of claim 11, wherein the compound is 4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]octane-1-carbaldehyde.

15. The compound of claim 11, wherein the compound is 4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]octane-1-carboxylic acid methyl ester.

16. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl]-acrylic acid methyl ester.

17. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl]-propionic acid methyl ester.

18. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl]-acrylic acid.

19. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl]-propionic acid.

20. The compound of claim 11, wherein the compound is 4-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl]-butyric acid.

21. The compound of claim 11, wherein the compound is Phosphoric acid mono-[4-(2,6-dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl] ester.

22. The compound of claim 11, wherein the compound is {[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]octane-1-carbonyl]-methyl-amino}-acetic acid.

23. The compound of claim 11, wherein the compound is {[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]octane-1-carbonyl]-amino}-acetic acid.

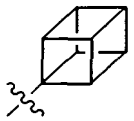
24. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yloxy]-propionic acid.

25. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yloxy]-propionic acid methyl ester.

26. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yloxy]-propionic acid t-butyl ester.

27. The compound of claim 11, wherein the compound is 3-[4-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[2.2.2]oct-1-yl]-2-methyl-propionic acid.

28. The compound of claim 6 wherein $\mathbf{R_3}$ is



and wherein $\mathbf{R_3}$ is either unsubstituted or functionalized with one or more substituents selected from the group consisting of R_5-alkyl, -R_5, R_5-alkenyl, alkoxycarbonyl, alkoxycarbonylalkenyl, hydroxyalkyl, aldehydo, and hydroxy.

29. The compound of claim 28, wherein the compound is 6-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-cubane-3-carboxylic acid.

30. The compound of claim 28, wherein the compound is 8-(6-Hydroxymethyl-cuban-3-yl)-1,3-dipropyl-3,7-dihydro-purine-2,6-dione.

31. The compound of claim 28, wherein the compound is 3-[6-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-cuban-3-yl]-acrylic acid.

32. The compound of claim 6 wherein $\mathbf{R_3}$ is

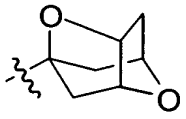
and wherein $\mathbf{R_3}$ is either unsubstituted or functionalized with one or more substituents selected from the group consisting of R_5-alkyl, -R_5, R_5-alkenyl, R_5-alkoxy, alkoxycarbonyl, alkoxycarbonylalkenyl, hydroxyalkyl, aldehydo, and hydroxy.

33. The compound of claim 32, wherein the compound is [5-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[3.2.2]non-1-yloxy]-acetic acid.

34. The compound of claim 32, wherein the compound is 8-(5-Hydroxy-bicyclo[3.2.2]non-1-yl)-1,3-dipropyl-3,7-dihydro-purine-2,6-dione.

35. The compound of claim 32, wherein the compound is 5-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-bicyclo[3.2.2]nonane-1-carboxylic acid.

36. The compound of claim 6 wherein $\mathbf{R_3}$ is



and wherein $\mathbf{R_3}$ is either unsubstituted or functionalized with one or more substituents selected from the group consisting of hydroxy, R_5-alkoxy, R_5-alkenyl, alkoxycarbonyl, and carbonyl.

37. The compound of claim 36, wherein the compound is 8-(4-Hydroxy-7-methyl-2,6-dioxa-bicyclo[3.3.1]non-1-yl)-1,3-dipropyl-3,7-dihydro-purine-2,6-dione.

38. The compound of claim 36, wherein the compound is [1-(2,6-Dioxo-1,3-dipropyl-2,3,6,7-tetrahydro-1H-purin-8-yl)-7-methyl-2,6-dioxa-bicyclo[3.3.1]non-4-yloxy]-acetic acid.

39. A medicament composition comprising a compound of claim 1 together with a suitable excipient.

40. A method of treating a subject suffering from a condition characterized by an elevated adenosine concentration and/or increased sensitivity to adenosine, the method comprising administering to the subject an effective adenosine antagonizing amount of a compound of claim 1.

41. The method of claim 40, wherein the condition is selected from the group consisting of cardiac and circulatory disorders, degenerative disorders of the central nervous system, respiratory disorders, diseases for which diuretic treatment is indicated, Parkinson's disease, depression, traumatic brain damage, post-stroke neurological deficit, respiratory depression, neonatal brain trauma, dyslexia, hyperactivity, cystic fibrosis, cirrhotic ascites, neonatal apnea, renal failure, diabetes, asthma, and edematous conditions.

42. The method of claim 40, wherein the condition is congestive heart failure or renal dysfunction.

43. A method of making 8-substituted xanthines comprising the steps of:

a) obtaining a N7,C8-dihydroxanthine;

b) protecting the N7 position of the xanthine;

c) deprotonating the C8 position with strong base to generate an anion;

d) trapping the anion with a carboxyl, carbonyl, aldehyde, or ketone compound; and

e) deprotecting the protected N7 position to obtain an 8-substituted xanthine.